



University
of Basel

BIOZENTRUM

The Center for
Molecular Life Sciences

**Setting trends
in basic research
and education.**

Molecular Life
Sciences.



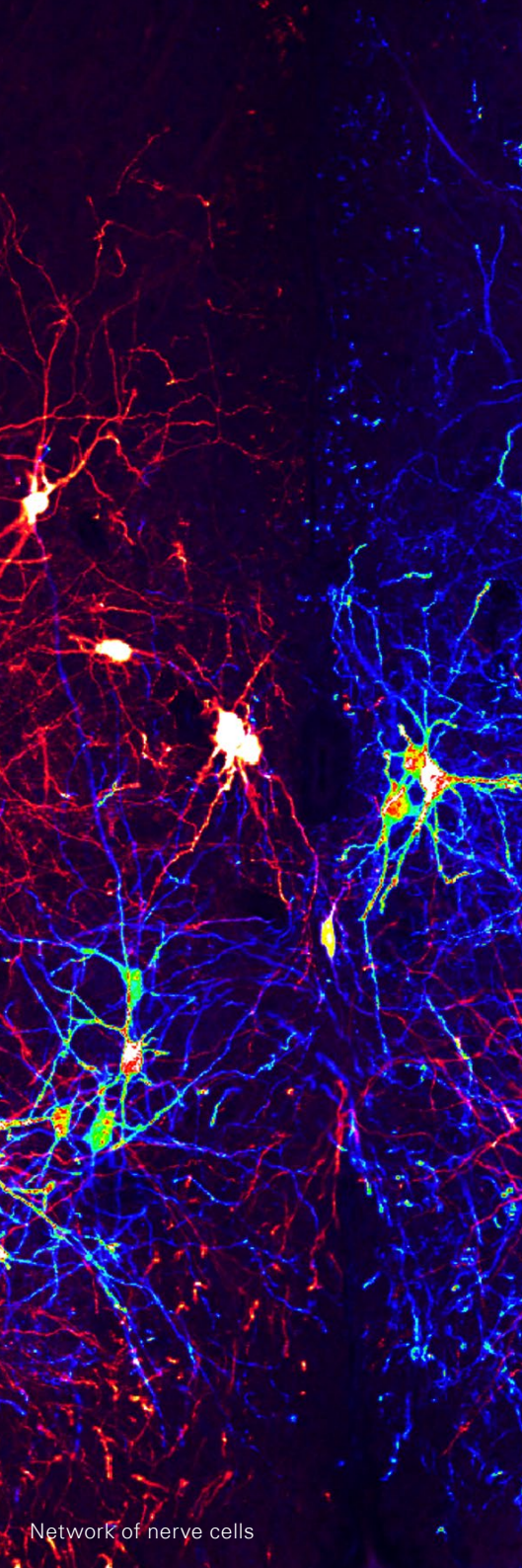
“ The Biozentrum has always represented excellence in molecular biology and genetics. When I started my career in science, it was already a beacon for good science and it still remains the case. ”

*Nobel Prize Laureate
Prof. Paul Nurse*

Innovative, interdisciplinary and international.

The Biozentrum of the University of Basel is one of the leading institutes worldwide for molecular and biomedical basic research and teaching. Daily, more than 30 research groups comprising scientists from over 40 nations investigate molecules, cells and whole organisms. Their common goal is to achieve a deeper understanding of the molecular basis of life. This involves dialogue between research fields and networking with industry to ensure the exchange of information essential for successful research. Ultimately, the scientists at the Biozentrum are laying the foundation for the development of new strategies in the treatment of major diseases.

Producing about 200 scientific publications every year, the Biozentrum is regularly in the top quarter of international rankings. Numerous honors and awards including the Nobel Prize attest to the Biozentrum's success – success due to an emphasis on interdisciplinary research. Interdisciplinarity, which was innovative and unique in Europe in 1971 when the Biozentrum was founded, remains a recognized strength. In addition, the Biozentrum offers an attractive setting with cutting-edge technology and 500 highly trained, dedicated employees. The location of the Biozentrum in Basel also contributes to its success. Embedded in Europe's most important life sciences hub – the trinational BioValley of Switzerland, Germany and France – the Biozentrum profits from close proximity to many universities and academic research institutes, over 600 life sciences and biotechnology firms, and two of the largest pharmaceutical companies in the world, Novartis and Roche.



Network of nerve cells

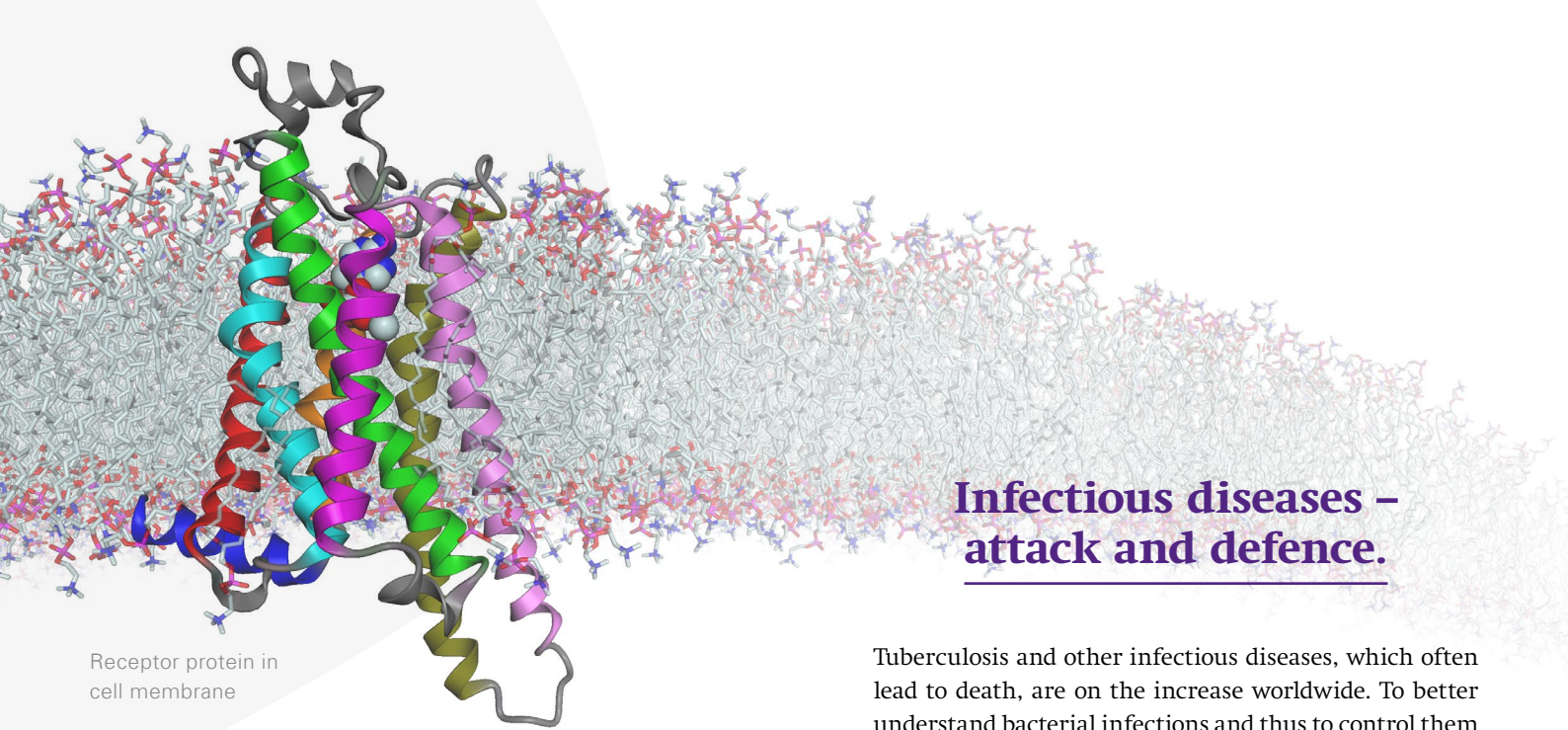
Fascinating basic research.

“ I became a scientist during my years at the Biozentrum. It was a great experience and set the path of the rest of my life. ”

*Nobel Prize
Laureate
Prof. Eric F.
Wieschaus*

How is a cell built and how does it function? How are vital processes regulated? How does a cell know to grow and then to stop growing? How does a stem cell know what it is intended to become? How do blood vessels form? How does the nervous system develop? How does our body defend itself against bacterial infections? With each insight gained, new questions arise. The primary goal of basic research is to look closely at these central questions, regardless of an immediate practical use. Yet, basic research invariably leads to unexpected answers to complex scientific problems and ultimately to findings that may be applied in medicine.

Research at the Biozentrum encompasses the fields of Cell Growth & Development, Infection Biology, Neurobiology, Structural Biology & Biophysics, and Computational & Systems Biology. Characteristic for its research is the strong emphasis on interdisciplinary collaborations within its walls as well as on a local level with the Departments of Biomedicine, Chemistry, Physics and Medicine, the Pharmacenter, the University Hospital Basel, the Swiss Tropical and Public Health Institute, the Swiss Nanoscience Institute, the Department of Biosystems Science and Engineering, the Friedrich Miescher Institut of Biomedical Research and, on an international level, with renowned research facilities.



Receptor protein in
cell membrane

Cell division and cell growth – a marvel of precision.

Organisms such as humans develop from a single fertilized egg cell. The basis of development and of life itself is the temporal and spatial regulation of interactions between molecules. These interactions are remarkably complex – countless processes take place in a cell simultaneously. The area of Growth & Development covers a great breadth of subjects, including signal transduction, gene regulatory networks, cell division and control of the cell cycle, membrane traffic, and mRNA transport. Each topic provides insights into fundamental biology, for example the development and function of organs, but also into diseases such as cancer.

Infectious diseases – attack and defence.

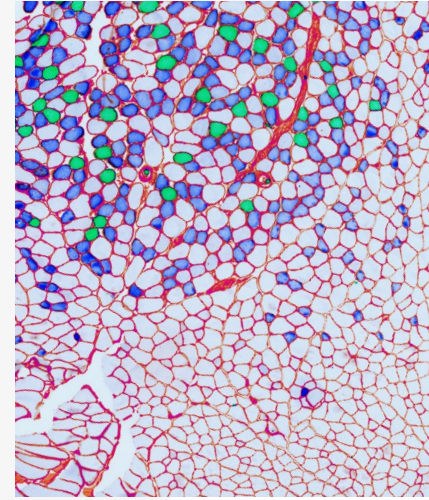
Tuberculosis and other infectious diseases, which often lead to death, are on the increase worldwide. To better understand bacterial infections and thus to control them more effectively, the infection biologists at the Biozentrum are investigating bacterial pathogens at the cellular and molecular level. A common interest in host-bacteria interactions provides the added value of synergism. However, their research reaches far beyond the immediate field of microbial pathogenesis. Their findings also impinge on basic principles of cellular biology such as signaling pathways, intracellular transport, the action of nanomachines, and microbial metabolism.

Highly complex information management in the brain.

Understanding the nervous system remains one of the biggest challenges in science. Our brain, composed of billions of individual neurons, is the organ of the body that determines who we are. It allows us to perceive our environment, to store memories and to steer our actions and emotions. The major focus of the neurobiologists at the Biozentrum is to understand the development of the nervous system. They investigate mechanisms underlying the formation of highly specialized nerve cell connections, the principles governing organization of neuronal networks, and the function of such networks in sensory perception and actions. These fascinating questions are of major importance with regard to disorders of the nervous system, such as neuromuscular diseases and autism, which represent some of the big health problems in society.

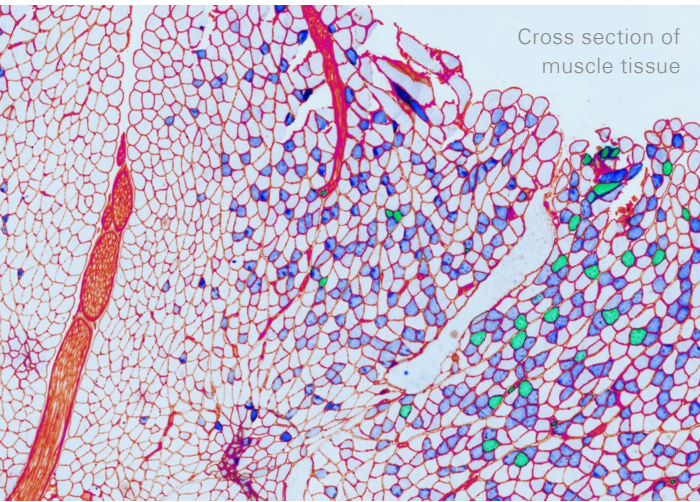
“The Biozentrum has made wonderful advances in science that have enriched my research and improved humanity.”

*Nobel Prize Laureate
Prof. Phillip A. Sharp*



Structure and dynamics of the molecules of life.

How does the shape and structure of biomolecules affect their function? How do the interactions between biomolecules lead to the phenomenon of life? The researchers in the area of Structural Biology & Biophysics are pursuing these questions using state-of-the-art technology, ranging from light, electron and scanning probe microscopy to X-ray crystallography and NMR-spectroscopy. They determine the three-dimensional structure and dynamics of cells and molecules – often down to the atomic level. A billionth of a meter and a billionth of a second are the units with which these scientists work – a description of the structure and physical forces in biological processes requires utmost precision.



Cross section of
muscle tissue

Living systems in silico.

The investigations of Computational & Systems Biology are at the interface of biology, mathematics and information technology. Modern high-throughput technologies allow hundreds of thousands of distinct molecular components to be measured in parallel. To extract meaning from such large datasets, sophisticated computational methods are developed to allow automated analyses. These computational methods also require that scientific hypotheses be expressed as formal mathematical models. Such integrated mathematical and computational modeling is used to study how complex interactions within a system determine biological behavior. The Biozentrum's scientists working in this area focus on computational modeling of protein structure and function, modeling and analysis of gene regulatory networks, and analysis of genome evolution.

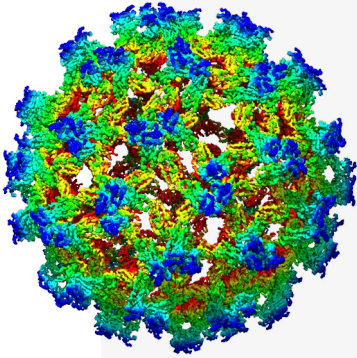
Young talent promotion at the highest level.

Bachelor's and Master's students benefit from close links to research in their course work. PhD students and postdocs from around the world are attracted by high-quality research and the international character of the Biozentrum.

Biology is the science of the 21st century. It is not only of central importance for basic research but also for the economy, the society and politics. Thus, biology provides a broad spectrum of career perspectives.

Excellent supervision, a modern infrastructure and the close link to molecular biological research make the bachelor's and master's degree programs at the Biozentrum particularly attractive for many aspiring students.

With its broad and interdisciplinary PhD program, the Biozentrum offers master's graduates a firstclass research environment for doctoral studies in molecular biology. To attract and support the best, young talent from around the world, the Biozentrum together with the Werner Siemens Foundation established the PhD program "Fellowships for Excellence" for outstanding graduates. Likewise, for postdoctoral fellows, the Biozentrum has an excellent reputation. The Biozentrum has also been the springboard for countless research careers: today, many of the Biozentrum alumni are established professors at distinguished institutions, or leaders in industry and business.



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Cover picture: Intestinal bacterium *Escherichia coli*

Picture back page: 3D virus structure

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